

PLATELET-RICH PLASMA APPLICATIONS IN MOLAR RETENTION AND DENTAL CYST SURGERY

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ABSTRACT

INTRODUCTION: Dental retentions and cysts are common pathology necessitating proper surgical treatment. During the recent decade, platelet-rich plasma has increasingly been used in oral surgery.

AIM: Our aim was to illustrate its application alone and in combination with autologous bone or collagen in patients after odontectomy for dental retention and cystectomy for dental cysts.

MATERIALS AND METHODS: A total of 53 patients, 28 males and 23 females, with retained molars or dental cysts were diagnosed and surgically treated between May 2017 and May 2019. Odontectomy was carried out in 36 patients and cystectomy - in 21 ones. According to an original protocol of platelet-rich plasma preparation, it was applied alone in 21, along with autologous bone - in 14, and combined with collagen - in 19 patients.

RESULTS AND DISCUSSION: The comparison with a sex- and age-matched control group without such applications demonstrated certain advantages in terms of the positive effects of platelet-rich plasma on wound healing, pain perception and bone regeneration.

CONCLUSION: Further research is needed to more comprehensively assess the benefits of these growth factors in oral surgery.

Keywords: molar retention, radicular cysts, oral surgery, platelet-rich plasma, autologous bone, collagen

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INTRODUCTION

Dental retentions are highly prevalent among the general population and their removal can involve multiple complications (1). The surgeon's detailed anatomical knowledge of the operated region proves crucial for the surgery outcome (2,3,4). Platelet-rich plasma application is proposed in an attempt to avoid these complications, as it contains numerous growth factors and stimulates diverse biological functions that facilitate the healing of soft and hard tissues.

Platelet-rich plasma is used in a variety of clinical situations in the field of oral surgery, e.g, in the post-extraction alveoli of retained lower third molars (1,5,6).

Platelet-rich plasma application reduces pain and inflammation, accelerates the epithelialization of soft tissues and promotes bone regeneration (7). When applied to the periodontal pocket, platelet-rich plasma exerts an anti-inflammatory therapeutic effect in 20 chronic periodontitis patients (8).

Combined use of platelet-rich plasma and bovine-derived hydroxyapatite graft materials for the treatment of intrabony defects of the fully impacted mandibular second molars following their surgical extraction provides early bone regeneration (9).

AIM

The purpose of the present study is to describe our method for therapeutic application of platelet-rich plasma alone as well as in combination with ei-

that of the male and female patients was 33.32 years (range, 14-68) and 30.80 years (range, 18-58), respectively. Fifty-three sex-matched patients in the control group (without any platelet-rich plasma application) were at a mean age of 31.30 years (range, 15-70). Males were aged 29.21 years (range, 15-70) on average and females - 30.84 years (range, 19-53) on average. It was noteworthy that 50% of the males and 60% of the females were aged ≤ 30 years as evidence of the social significance of this pathology.

Odontectomy was performed for mandibular and maxillary impacted molars but cystectomy was done for radicular cysts according to a routine oral surgical protocol.

Male and female patients' distribution according to the diagnosis and the kind of platelet-rich plasma application (alone, in combination with autologous bone, and with collagen) is demonstrated in Table 1.

Table 1. Platelet-rich plasma applications in patients with retained molars and radicular cysts

Diagnosis	PRP Alone		PRP+Bone		PRP+Collagen		Total
	Males	Females	Males	Females	Males	Females	
Single retained molar	5	4	4	2	5	4	24
Single reticular cyst	5	1	-	4	5	-	15
Two retained molars	-	4	-	2	-	2	8
One molar and two cysts	1	-	-	1	1	-	3
Two reticular cysts	-	-	-	-	2	-	2
Four retained molars	-	-	1	-	-	-	1
Three reticular cysts	1	-	-	-	-	-	1
total	12	9	5	9	13	6	54*
	21		14		19		54*

PRP - protein-rich plasma

*In one patient, two consecutive surgical interventions were performed.

ther autologous bone or collagen in patients with dental retention and dental cysts.

MATERIALS AND METHODS

Our study covered a total of 53 randomly selected patients, 28 males and 23 females, with retained molars or dental cysts diagnosed and surgically treated in the Department of Oral and Maxillofacial Surgery of the Medical University of Varna during the period from May 2017 to May 2019. The mean age of the whole group was 32.13 years (range, 14-68) and

Protocol for Platelet-Rich Plasma Production

Fifteen mL of a patient's blood were added to a mixture of 1 mL of citrate, phosphate, dextrose and alanine in two sterile containers. Twofold blood centrifugation was done. The first procedure was performed at 2400 rev/min. for 10 min. in order to separate erythrocytes from plasma (Fig. 1). Supernatant plasma was put by using sterile pipette into new sterile test tubes for the second centrifugation at 3600 rev/min. for 15 min. in order to concentrate plate-

lets in a platelet-rich plasma (Fig. 2). The latter was at the bottom of the test tube as a 10-percent fraction while the rest of the plasma was considered platelet-poor plasma. To the platelet-rich plasma separated from the platelet-poor one by using sterile pipette, 1 mL of 10% of a calcium dichloride solution was added in order to activate the platelet-rich plasma. Collagen addition to the platelet-rich plasma is shown on Fig. 3 and autologous bone preparation is displayed on Fig. 4. The favourable effects on bone regeneration of these platelet-rich plasma applications during different intervals after surgery were comparatively assessed between both groups.

RESULTS

Odontectomies and cystectomies were performed in 36 and 21 patients, respectively. Platelet-rich plasma in combination with autologous bone was applied more frequently in females while in combination with collagen - in males.

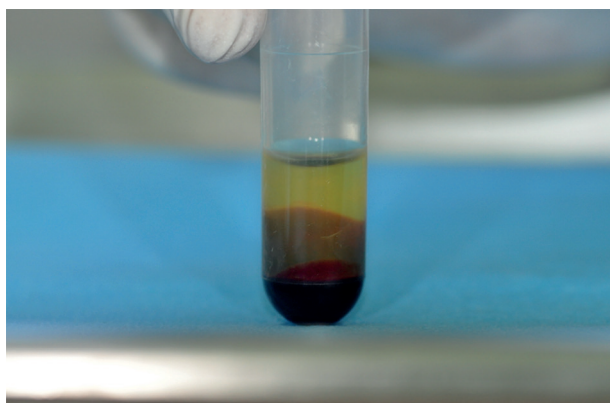


Fig. 1. Separation of plasma from erythrocytes after the first centrifugation



Fig. 2. Pure platelet-rich plasma

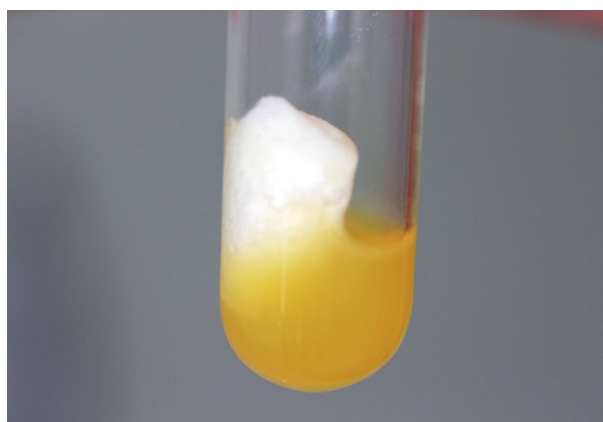


Fig. 3. Collagen addition to platelet-rich plasma



Fig. 4. Autologous bone prior to placement

Bone defects immediately after odontectomy and cystectomy are indicated on Fig. 5 and Fig. 6.



Fig. 5. Bone defect after odontectomy

Placements of platelet-rich plasma alone and with autologous bone into the osseous defects are demonstrated on Fig. 7 and Fig. 8.



Fig. 6. Bone defect after cystic sack extirpation

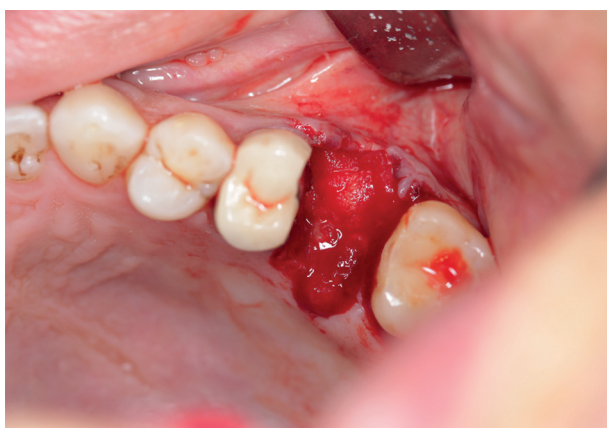


Fig. 7. Platelet-rich plasma placement into the osseous defect



Fig. 8. Placement of platelet-rich plasma with autologous bone into the osseous defect

Our results demonstrate certain advantages of the platelet-rich plasma applications in the patients with dental retention and cysts in terms of pain perception and bone density. However, because of the

relatively small sample of ours, they remain statistically insignificant ($p > 0.05$).

DISCUSSION

Our results are similar to those reported in the foreign scientific literature.

A new technique for odontectomy of deeply impacted mandibular third molars using computer-guided cutting to maintain inferior alveolar nerve integrity and the covering buccal bone is positively evaluated (10).

Recently, the interest in the applications of variety of products containing growth factors in oral surgery has gradually increased.

Within a single-site, randomized-controlled investigation of the clinical and histologic outcome of using medical-grade calcium sulfate hemihydrate mixed with platelet-rich plasma for extraction socket preservation graft before implant placement it is proved that there is greater vital bone volume at three months with rapid enhancement of bone healing compared to platelet-rich plasma-free collagen resorbable graft (11).

Healing of platelet-rich plasma-treated mandibular and maxillary molar sockets differs statistically significantly from that of control sockets at one-, three-, and six-month follow-up and provides a safe and effective means of speeding alveolar bone repair and new bone formation following impacted third molar extraction (12). Autologous platelet-rich plasma applied in tooth sockets after extractions of bilateral impacted mandibular third molars accelerates alveolar bone regeneration and ensures a better repair in men than in women (13,14).

Nowadays platelet-rich fibrin is relatively commonly used during lower third molar extractions. A meta-analysis of 10 studies retrieved from *PubMed*, *Web of Science*, *EMBASE*, and the *Cochrane Library* and including 468 cases of platelet-rich fibrin application and 467 cases of non-platelet-rich fibrin one demonstrates that platelet-rich fibrin statistically significantly relieves pain ($p = 0.01$) and three-day postoperative swelling ($p = 0.03$) as well as reduces alveolar osteitis incidence rate ($p < 0.0001$) (15). Another meta-analysis of randomized clinical trials dealing with alveolar osteitis concludes that platelet-rich fibrin accelerates healing in mandibular third molar surgery by reducing postoperative pain and swelling

and reduces alveolar osteitis prevalence rate as well (16). There is markedly greater bone formation in bilaterally impacted mandibular third molar sockets as well as a better osseous regeneration and soft tissue healing after treatment with platelet-rich fibrin (17). Autologous platelet-rich fibrin application lessens the severity of immediate postoperative sequelae, decreases preoperative pocket depth, and hastens bone formation in mandibular third molar extraction sockets (18).

Among 5294 cases of jaw cysts diagnosed during a 38-year period, radicular cysts are most common followed by dentigerous, residual, and odontogenic keratocysts (19). During the period from January 2001 to December 2016 in Southern Taiwan, 232 patients, 133 females and 99 males at a mean age of 40.5 years (range, 13-78 with radicular cysts are diagnosed (20). Some 201 cysts occur in the maxilla (86.64%) and 31 ones - in the mandible (13.36% of the cases).

According to data from 16 studies, the prevalence of odontogenic cysts associated with impacted third molars is 4.4% (between 2.5 and 6.8% at 95% confidence interval) (21). The dentigerous cyst is mentioned in eleven studies with a pooled prevalence of 2.1% (between 1.4 and 3.1% at 95% confidence interval), the radicular cyst - in three studies and with a prevalence of 4.7% (between 0.0 and 19.4% at 95% confidence interval) and the odontogenic keratocyst - in nine studies and with a prevalence of 0.5% (between 0.2 and 0.7% at 95% confidence interval).

Among 7259 biopsy records of elderly patients from four Brazilian referral centres between 2000 and 2016, there are 491 odontogenic (76.5%) and 76 non-odontogenic cysts (11.8%) (22). There are 268 radicular and 21 salivary duct cysts. Among 2114 biopsy records of Brazilian children between 1980 and 2016, there are 294 odontogenic (76.5%) and 16 non-odontogenic cysts (11.8%) (23). There are 145 radicular and four epidermoid cysts. During a 10-year period, a total of 526 cysts are diagnosed in 330 males and in 196 females in Ataturk University, Eastern Turkey (24). There are 509 odontogenic and 17 non-odontogenic cysts, mainly radicular (66.4%), dentigerous (19.2%) and residual (10.8%) cysts.

In a randomized prospective comparative study of 20 patients with periapical osseous jaw defects,

use of platelet-rich plasma combined with calcium sulfate and autologous bone graft results in a better bone regeneration (25). The results of a prospective, randomized trial in 67 healthy children aged 8-11 years with 88 immature necrotic incisors demonstrate that the applications of platelet-rich plasma, platelet-rich fibrin, a platelet pellet and an induced blood clot are effective in regenerative endodontic procedures (26). Autologous platelet concentrates including platelet-rich plasma, platelet-rich fibrin and plasma rich in growth factors used following tooth extraction improve soft tissue healing, probing depth and bone density, as well as reduce swelling and trismus (27). According to a meta-analysis of the 222 immature permanent teeth, platelet-rich plasma and platelet-rich fibrin induce more effectively apical closure than blood-clot revascularization for the regeneration of these teeth (28).

The comparative investigation of autologous bone, platelet-rich plasma and two biomaterials such as synthetic calcium hydroxyapatite and demineralized bone matrix proves that autologous bone is the gold standard material for alveolar bone regeneration after impacted mandibular third molar extraction (29). Within a prospective, randomized, single-blind split-mouth study, the application of an alloplastic bone graft (collagen and hydroxyapatite) following surgical removal of bilateral impacted mandibular third molars results in an alveolar bone level increase, probing depth improvement, and better wound healing and prevents the periodontal defects distal to mandibular second molars (30).

Pure type-1 collagen application to the third molar extraction socket can reduce post-operative pain score and duration, decrease the frequency of mouth-opening limitation, and increase mineralization ratio at the extraction socket site (31). Collagen membranes promote wound healing through isolation, clot stabilization, wound stability, and hemostasis, enhance primary wound coverage through their chemotactic ability to attract fibroblasts, and augment flap thickness by providing a collagenous scaffold after partially impacted mandibular third molar surgery (32). The resorbable collagen membranes after surgical extraction of mesioangular or horizontally impacted lower third molar stimulates bone regeneration by improving the attachment level and bone fill

distal to the lower second molar, decreases the distal probing depth and results in faster recovery (33).

In a 10-year-old girl presenting with a large radicular cyst associated with neglected carious mandibular deciduous second molar, a successful surgical management using autologous platelet-rich fibrin augmentation results in accelerated healing of the bone defect (34). A 20-year-old female presenting with forced root-filling material outside the root canal of 45th tooth reaching the radicular cyst around the root and the mandibular canal is successfully treated by means of timely cystectomy and filling material removal (35).

CONCLUSION

Our preliminary results encourage us to further investigate the beneficial effects of these growth-factor containing platelet-rich plasma applications in oral surgery.

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